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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scor are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict jcb performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

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TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

PAINTER-DECORATOR (const.) 5-27.010 and 5-28.100

B-476 or S-203

U. S. Employment Service in
Cooperation with
Illinois and Pennsylvania State Employment Services

September 1962

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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

PAINTER-DECORATOR 5-27.010 and 5-28.100

B-476 or S-203

Summary

The General Aptitude Test Battery, B-1002A, was administered to two samples of apprentices enrolled in the Apprenticeship program for Painter-Decorator 5-27.010 and 5-28.100 at the Washburne Trade School, Chicago, Illinois. The GATB, B-1001, was administered to a third sample of students enrolled in a course for Painter-Decorator 5-27.010 and 5-28.100 at the Williamson Free School of Mechanical Trades, Williamson, Pennsylvania. Table I below shows the year in which data collection was completed, the number included in the final sample, and the type of criterion used for validation purposes for each sample.

TABLE I

Sample	Year	N	Criterion
I (Illinois)	1957	70	Instructors' Ratings
II (Illinois)	1960	83	Instructors' Ratings
III (Pennsylvania)	1957	49	Course Grades

Data for the three samples were analyzed separately and in combination. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes N-Numerical Aptitude, S-Spatial Aptitude, F-Finger Dexterity and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Painter-Decorator 5-27.010 and 5-28.100, B-476 or S-203

Table II shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Painter-Decorator 5-27.010 and 5-28.100.

TABLE II

Minimum Acceptable Scores on B-1001 and B-1002 for B-476 or S-203

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
N	CB-1-D CB-1-I	95	N	Part 2 Part 6	90
S	CB-1-F CB-1-H	105	S	Part 3	100
F	CB-1-O CB-1-P	85	F	Part 11 Part 12	80
M	CB-1-M CB-1-N	80	M	Part 9 Part 10	80

Effectiveness of Norms

The data in Table VII indicate that 44 of the 69 poor workers, or 64 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 64 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 94 of the 119 workers who made qualifying test scores, or 79 percent, were good workers.

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Painter-Decorator 5-27.010 and 5-28.100.

II. Sample

This study is based on three samples of students preparing for Painter-Decorator 5-27.010 and 5-28.100 occupations in Chicago, Illinois and Williamson, Pennsylvania. The test norms were developed on the basis of the results of the combined data for the three samples.

Samples I and II - Illinois

The GATB, B-1002A, was administered during April to May 1957, to 159 males enrolled in the apprenticeship program for Painter-Decorator 5-27.010 and 5-28.100 at the Washburne Trade School, Chicago, Illinois. Applicants are not selected for the program on the basis of tests but preference is given to applicants who are high school graduates or the equivalent and pysically fit for the work of Painter-Decorator.

The criterion consisted of instructors' ratings on a descriptive rating scale. Criterion data were collected when each apprentice completed at least 30 months of the program. In November, 1957, 70 men had met this requirement and these men constitude Sample I. By June, 1960, an additional 83 men had completed the minimum 30 months of training and these men constitude Sample II.

Sample III - Pennsylvania

The GATB, B-1001, was administered during the period May 1952 to April 1957 to a total sample of 49 male students in a course for Painter-Decorator 5-27.010 and 5-28.100 at the Williamson Free School of Mechanical Trades, Williamson, Pennsylvania. Applicants for the course are selected on the basis of school records, physical examination, aptitude tests and interview. Table III shows the means, standard deviations, ranges, and Pearson product-moment correlations with the criterion for age, education, and experience for the various samples.

TABLE III

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

N = 202

	N	M	σ	Range	r
Age (years)					
Sample I - Illinois	70	23.6	2.6	19-31	.191
Sample II - Illinois	83	24.0	2.7	20-30	.190
Sample III- Pennsylvania	49	18.1	1.3	16-21	.446**
Combined Sample	202	22.4	2.2	16-31	
Education (years)					
Sample I - Illinois	70	11.0	1.5	6-15	.233
Sample II - Illinois	83	11.2	1.5	8-16	.302**
Sample III - Pennsylvania	49	10.7	.9	9-12	.237
Combined Sample	202	11.0	1.3	6-16	
Experience (months)					
Sample I - Illinois	70	32.5	2.1	30-36	.079
Sample II - Illinois	83	32.4	1.7	30-35	.014
Sample III - Pennsylvania	49				

**Significant at the .01 level

III. Job Description

Job Title: Painter-Decorator 5-27.010 and 5-28.100.

Job Summary: Prepares and applies protective and decorative coats of paints and related materials with brush, roller, and spray to interior and exterior surfaces of buildings. Mixes paint and matches colors by stirring together the proper proportions of pigment, base, and thinner. Uses brushes and spray gun to apply paint. Erects working scaffold. Removes old paint by applying liquid paint remover or by heating surface with blowtorch and scraping off paint.

Work Performed: Sets up equipment: Arranges and assembles scaffolding units or constructs them from lumber, ladders, brackets, metal hooks and ropes; inspects and positions ladders; protects furniture and floor or shrubberies with drop cloths; and arranges to do the work so as to cause as little inconvenience to tenants, as possible while work is in progress. Determines type of paint to apply to surfaces, using knowledge of paint reaction to the many kinds of surfaces and varying conditions of heat, cold, water, fumes, or chemicals. Erects paste table.

Prepares the surface: Prepares surface by washing and rinsing with soaps, detergents and sponges; removes paint with remover, scraper, wire brush, and blow torch; fills cracks, crevices, and holes with putty, crack filler, and plaster; sand-papers, swedish putties imperfections, dents, etc., and touches up patches with proper sealers.

Prepares the materials: Mixes plaster, swedish putty, common putty, lead putty, paste and special crack and wood fillers; prepares sizes, sealers, adhesive, and protective coatings; stirs many specific types of paints to obtain and maintain a proper working consistency; mixes, blends, and matches paints in proper proportions of vehicle and pigment based on surface and coat number; matches paints, stains and finishes to approved color samples. Plans and tears paper according to design and surface size and shape.

Applies the materials: Applies paint materials using brush, roller, or spray, depending upon types of surface; applies primer, sealer, stains, filler, size, shellac, lacquer, calcimine, casein paint, resin emulsion paint, latex paint, acrylic paint, flat paint, transparent and opaque protective coatings, rust inhibitive paint with appropriate tools; applies proper number of coats to produce desired results; decorates over prepared and painted surface, highlighting, mottling, stippling, straiting, glazing, wiping, tiffanizing, graining and marbling. Uses rags, wire brushes, steel wool, brushes, steel combs, feathers, sponges, wads of paper, and chamois skins to modify glazing liquid, paint or texture paint to produce desired decorative effects; paints, lines, or stripes lines on surfaces to produce imitation brick or tile finish; rubs enameled, lacquered, and varnishes surfaces; waxes and polishes

woodwork and paneled rooms, may paint scenics or make decorative designs with transfers and stencils; hangs wallpaper and other materials to walls, ceilings and other surfaces; waterproofs basements;replaces loose putty on exterior of sashes; removes wood finishes with removers; bleaches, stains fills, seals, and finishes any type of woodwork; finishes floors.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to Sample groups I and II. All tests of the GATB, B-1001, were administered to Sample III.

V. Criteria

Samples I and II - Illinois

The criterion consisted of instructions' ratings based on the Descriptive Rating Scale developed by the Bureau of Employment Security, Form SP-21. The instructor prepared ratings and reratings for each apprentice with a six-week interval between the first and second rating. Since the product-moment correlation between the two ratings for Sample I was .94, and for Sample II was .95, the average of the two ratings was used as the final criterion for validation purposes for each sample.

Sample III - Pennsylvania

The criterion consisted of final grade scores received in the trade theory course. Consideration was given to the use of three criteria: final course grades in trade theory, trade practice, and drawing. After the criteria were evaluated, it was decided that final grades in the trade theory course would be the best criterion for use for this study because only this course represented actual accomplishment in this field.

Combined Sample

The dichotomized criterion for the combined sample was established by assigning the individuals in the high and low criterion groups of each separate sample to these respective groups for the combined sample.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis:

The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Intelligence (G) - required to learn the type and physical properties of protective and decorative coatings; required in selecting materials for suitable method of application, depending upon type of coating, surface, and purpose of application.

Form Perception (P) - required to inspect for cracks, crevices, and holes; to apply coats of paint or glazing liquids for decorative effects; to paint scenics or make decorative designs with transfers and stencils.

Motor Coordination (K), Finger Dexterity (F), and Manual Dexterity (M) - required to arrange, assemble or construct scaffolding; to move and replace furniture and to clean and replace hardware and fixtures; to prepare surfaces, fill cracks, crevices and holes with putty, and to mix plaster and apply paint materials.

On the basis of the job analysis data, the following aptitudes are considered obviously unimportant for performing the duties of this job and are considered "irrelevant" aptitudes: Verbal Aptitude (V) and Clerical Perception (Q).

B. Quantitative Analysis:

Table IV shows the means and standard deviations for the combined sample (N-202) for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general population norms with a mean of 100 and a standard deviation of 20.

TABLE IV

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

N = 202

Aptitudes	M	σ
G-Intelligence	105.8	14.4
V-Verbal Aptitude	96.5	13.4
N-Numerical Aptitude	102.6	15.3
S-Spatial Aptitude	114.4	19.1
P-Form Perception	106.8	14.8
Q-Clerical Perception	99.3	12.7
K-Motor Coordination	98.9	16.2
F-Finger Dexterity	98.4	17.8
M-Manual Dexterity	103.0	18.1

Table V shows product-moment correlations coefficients with the criterion for the aptitudes of the GATB for each sample separately.

TABLE V

Aptitudes	Sample I-Illinois (N-70)	Sample II-Illinois (N-83)	Sample III Penn. (N-49)
	r	r	r
G	.455**	.392**	.397**
V	.226	.278*	.306*
N	.435**	.329**	.318*
S	.493**	.254*	.297*
P	.399**	.228*	.093
Q	.192	.272*	.130
K(T)	.148	.210	.311*
F	.304*	.201	.171
M	.218	.275*	.267

*Significant at the .05 level
**Significant at the .01 level

Aptitudes G, S, and P have the highest mean scores and aptitudes G, V, P, and Q have relatively low standard deviations. For Sample I, 70 cases, correlations of .307 and .236 are significant at the .01 level and the .05 level of confidence, respectively. Aptitudes G, N, S, and P correlate significantly with the criterion at the .01 level. Aptitude F correlates significantly with the criterion at the .05 level. For Sample II, 83 cases, correlations of .281 and .216 are significant at the .01 level and the .05 level of confidence, respectively. Aptitudes G and N correlate significantly with the criterion at the .01 level. Aptitudes V, S, P, Q and M correlate significantly with the criterion at the .05 level. For Sample III, 49 cases, correlations of .365 and .282 are significant at the .01 level and the .05 level of confidence, respectively. Aptitude G correlates significantly with the criterion at the .01 level. Aptitudes V, N, S and T correlate significantly with the criterion at the .05 level.

C. Selection of Test Norms

TABLE VI

Summary of Qualitative and Quantitative Data

Type of Evidence	G	V	N	S	P	Q	K(T)	F	M
Job Analysis Data									
Important	X				X		X	X	X
Irrelevant		X				X			
Relatively High Mean (N-202)	X			X	X				
Relatively Low Sigma (N-202)	X	X			X	X			
Significant Correlation with Illinois Criterion (N-70)	X		X	X	X			X	
Significant Correlation with Illinois Criterion (N-83)	X	X	X	X	X	X			X
Significant Correlation with Penn. Criterion (N-49)	X	X	X	X			X		
Aptitude to be considered for Trial Norms	G		N	S	P		K	F	M

Trial norms consisting of various combinations of Aptitudes G, N, S, P, K, F, and M with appropriate cutting scores were evaluated against the criterion by means of the tetrachoric correlation technique. A comparison of the results showed that B-1002 norms consisting of N-90, S-100, F-80 and M-80 had the best selective efficiency.

VII. Validity of Norms

The validity of the norms was determined by computing a tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test.. The final criterion for the combined sample was dichotomized by placing 34 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal students. (The dichotomized criterion for the combined sample was established by assigning the individuals in the high and low criterion groups of each separate sample to these respective groups for the combined sample.)

Table VII shows the relationship between test norms consisting of Aptitudes N, S, F and M with critical scores of 90, 100, 80 and 80, respectively, and the dichotomized criterion for Painter-Decorator 5-27.010 and 5-28.100. Students in the high criterion group have been designated as "good students" and those in the low criterion group as "poor students."

TABLE VII

Validity of Test Norms for Painter-Decorator 5-27.010 and 5-28.100

(N-90, S-100, F-80, M-80)

N = 202

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Students	39	94	133
Poor Students	44	25	69
Total	83	119	202

$r_{tet} = .52$ $\quad \chi^2 = 20.867$

$\sigma_{r_{tet}} = .11$ $\quad P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes N, S, F, and M with minimum scores of 90, 100, 80, and 80, respectively, have been established as B-1002 norms for the occupation of Painter-Decorator 5-27.010 and 5-28.100. The equivalent B-1001 norms consist of N-95, S-105, F-85, and M-80.

IX. Determination of Occupational Aptitude Pattern

A significant relationship between OAP-25 and the criterion for the experimental sample was obtained. The proportion of the sample screened out by OAP-25 was .21, which is within the required range of .10 to .60. Therefore, the occupation Painter-Decorator 5-27.010 and 5-28.100 will be allocated to OAP-25 of the existing 35 OAP's (Revised 10/61).